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ABSTRACT

Presented is a review of findings from research of teaching in the 1970's. It is noted most research was directed toward identifying effective instructional strategies for low achievers, and may not generalize to high achievers. Information is related to student time on task, length of school day, academic time, allocation of time to specific activities, teacher focus of instruction, and interactive instruction. Details of a study on mathematics instruction conducted in 11 San Francisco Bay urban and suburban high schools are provided. The main conclusion is that students in general mathematics classes may not receive the teacher attention and instruction required to achieve well and continue in mathematics. Next, a report on differential treatment of men and women in mathematics classes found differences in geometry classes, but these did not relate to the enrollment of women in advanced mathematics. This document asks if the instructional strategies found effective in reading and mathematics are effective for science classes. An observation system that can be used in science classrooms so that instructors can answer questions about teaching practices is detailed. A study using these techniques to describe effective science teaching is called for, and the need for renewed research in science programs is expressed. (MP)

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CLASSROOM RESEARCH: IMPLICATIONS FOR MATHEMATICS AND SCIENCE INSTRUCTION

Presented to the

BIOLOGICAL SCIENCE CURRICULUM STUDY CONFERENCE

Boulder, Colorado - November 7, 1980

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EXPLORATORY ANALYSIS OF TEACHING IN
MATHEMATICS AND SCIENCE CLASSROOMS

During the 1970s most of the research on teaching focused upon effective instruction in compensatory reading and mathematics classes. The theory was that if the basic skills of low income students were improved then their chances to gain meaningful employment would also improve. Because such a large proportion of funds available to education were allocated to categorical aide programs, most of the research and evaluation funds were directed toward identifying effective instructional strategies for low achieving students. Thus, it is important to keep in mind that reviewing the findings from the research on teaching in the 1970s may not generalize to high achieving students.

Research on Teaching Basic Mathematics and Reading

One of the most potentially useful variables to emerge from the research on teaching during this era was student time on task. Many educators are now convinced that if student time on task is increased, an increase in student achievement will follow. This belief is based on a considerable amount of research that focused on the length of school days, actual scheduled class time, time allocated to academic subjects, and student engaged time.

Length of School Day

The length of a school day in elementary school or the length of a class period in secondary schools defines the maximum amount of time available for instruction. Within that maximum amount of time is the actual amount of time that is allocated to reading and mathematics instruction. Several studies by Stallings, et al, at SRI International indicate that the length of the school day or the length of class period is not related to student achievement in reading and mathematics. First grade classrooms in the National Follow Through

Observation Study (Stallings, 1975) varied as much as one hour and 30 minutes in length of school day; secondary class periods for remedial reading varied from 40-55 minutes (Stallings, Needels, and Stayrook, 1979). Such differences are not associated with reading or mathematics gain. These findings indicate that student learning depends on how the time that is available is used.

Academic Time

Although length of school day was not a predictor of student gain in these studies, the amount of time spent in academic subjects has been found to be positively associated with gain in mathematics and reading. In the Follow Through Observation Study, time spent in mathematics, reading, and academic verbal interactions was related to achievement. Time spent working with textbooks and workbooks (as opposed to time spent with puzzles, games, and toys) was related to achievement in reading and mathematics. Time spent in small groups (as opposed to one-to-one instruction) was also associated with student academic gain. Conversely, time spent in more exploratory activities was positively related to scores on a nonverbal problem-solving test and to lower student absence rate. Similar relationships were also found in a study of California third grade Early Childhood Education classes (Stallings, Cory, Fairweather and Needels, 1977). These findings indicate that what teachers teach and how time is spent makes a difference in what students learn.

Research conducted at Far West Laboratory as part of the Beginning Teacher Evaluation Study (BTES) (Fisher, et al, 1977) found associations between academic learning time and student achievement. Powell and Dishaw (1980), reporting data from the BTES, show that the time allocated to reading and mathematics for second graders ranged from 62 minutes to 123 minutes per day. This time for fifth graders ranged from 49-105 minutes per day. The correlation of allocated learning time with achievement varied from one sub-test to another.

Time on Task

The amount of time students actually spend on task is, of course, related to student gain. Teachers can allocate time in their schedule for mathematics or reading but if students socialize and misbehave gain will not be achieved. Powell and Dishaw, in the BTES study, reported that the engaged time of second grade students varied from 38 minutes to 98 minutes, and that of fifth grade students varied from 49 to 105 minutes. Student engaged time was positively associated with student achievement in all tests and at both grade levels.

Stallings, et al, (1979) in a study of secondary classrooms found a negative relationship between student gain and interruptions such as the loud speaker or tardy students. Each time one of those disruptive events occurred student's eyes left their work and it took time to get back on task. In recent reviews and studies there has been a consistency in the relationship between time-on-task and student accuracy rates (Berliner, 1976; Brophy, 1979; Good, 1980; Rosenshine, 1979).

Allocation of Time to Specific Activities

The body of knowledge emanating from the research on teaching in the 1970s suggests that teachers should allocate more time to academic subjects, keeping in mind ability levels, and students should be kept engaged in the tasks. Such a recommendation will confirm what most teachers and administrators already know; however, the recommendation is not very helpful unless more specific statements are made about how to engage students and how to use academic time. It is of interest to know what activities occur within a class period, and how the time for those activities is distributed. If a class period has 45 minutes, how long does it take the teacher to get the

show on the road? What is the balance of silent reading, written assignments, recitation/discussion, and instruction? Does the distribution of class time across activities make a difference in student achievement. If so, does this difference vary among students with different achievement levels? A two-phase study conducted in 87 secondary remedial classrooms found that the allocation of time to specific reading activities significantly affects student reading gain; further, this distribution of time affects students in specific reading levels in different ways. This study, The Teaching of Basic Reading Skills in Secondary Schools (TBRSSS), was funded by the National Institute of Education (NIE) and carried out at SRI International by Stallings, Needels, and Stayrook (1979).

Focus of Instruction

To whom should teachers focus their instruction: individuals, small groups, the total group? During the last decade considerable energy has been directed toward the development of individualized programs. Federal, state and local funds have been spent to develop programmed reading, mathematics and science books. All of these programmed materials were aimed at providing children with activities in which they could progress at their own rates. It was assumed that if students were working at their own pace through a series of sequential exercises, learning would occur; it did for some students and not for others. In general, there has been a great disillusionment in individualized instruction. Some students learn best when new information is presented to a small group of students who are operating at a similar pace (Stallings, 1975; Stallings, Needels and Stayrook, 1979). Learning occurs when students read aloud, hear others read aloud, and hear others ask questions

and respond. Hearing and speaking as well as reading and writing helps students integrate and retain information. Individualized programs based almost totally on workbooks do not allow for this type of group learning.

At a conference sponsored by the National Institute of Education (1978), where the failure of individualized instruction was discussed with teachers, teachers reported that they felt relegated to being record keepers. Workbooks were relied upon to provide instruction for students. It appears that students need the interaction of teachers. A teacher can develop concepts with a group and can change examples or illustrations to coincide with the group's background experience. If students do not understand, the teacher can find yet another example. Books or machines do not do that. Books or machines provide opportunities to practice and reinforce what teachers are teaching, but research suggests (Stallings, 1975) they are not sufficient to provide the instruction that students need.

Interactive Instruction

In the study of time allocated to specific activities (TBRSSS) it became clear that teachers who were interactive in their instructional style had students who achieved more in reading. An interactive style included providing oral instruction for new work, discussing and reviewing student work, providing drill and practice, providing acknowledgement for correct responses and supportive corrective feedback for incorrect responses. The correlation between interactive instructional style and student learning was replicated in Phase II of the study.

In summarizing the research on active instruction Brophy (1979) states: "Learning gains are most impressive in classrooms in which students receive a great deal of interaction with the teacher, especially in public lessons and recitations that are briskly paced but conducted at a difficulty level that allows consistent success."

A Comparison of Instructional Styles in Secondary, General, and Advanced Mathematics Classes

Mathematics instruction was studied in eleven San Francisco Bay urban and suburban high schools (Stallings and Robertson, 1979). The sample included 91 classrooms sorted into three types:

Type I included general mathematics and pre-algebra, required for high school graduation.

Type II included albebra I and geometry, required for entry into the California University system.

Type III included trigonometry, algebra II, calculus, required for entry into some university science and mathematics programs.

Each of the 91 classrooms was observed for three class periods using a low-inference objective observation system. The allocation of time to activities, the focus of instruction and the teachers' instructional style were recorded. Instructional style findings were based upon approximately 900 recorded interactions.

The manner in which mathematics instruction differs in general mathematics classes and geometry classes can be studied with these data. The SRI observers informally reported that general mathematics classes appeared to be much less task-oriented and the teacher seemed less involved in teaching the students. To see whether or not this was true, we compared the kinds of activities occurring in the Type I, Type II, and Type III classrooms.

Data from the observation of activities (see Table 1) indicate that Type II and III teachers offer more instruction (S5) and discussion (S6) than do the Type I teachers. They also spend less time doing classroom management tasks during the class period. This is grading papers or keeping records.

Table 1

PERCENTAGE OF OCCURRENCE OF ACTIVITY VARIABLES
FOR THREE TYPES* OF MATHEMATICS CLASSES

	Variables	All Classes Type I $\bar{x}$	All Classes Type II $\bar{x}$	All Classes Type III $\bar{x}$
S1	Teacher Class Management, No Students	23.222	20.260	15.175
S4	Making Assignments	0.929	1.039	2.077
S5	Instruction	14.895	25.353	30.512
S6	Discussion/Review	8.091	20.800	23.216
S8	Written Assignments	33.755	14.807	11.122
S9	Test Taking	3.865	2.147	2.054
S11	Social Interaction	10.610	12.672	13.797
S12	Student Uninvolved	11.022	6.252	3.471
S13	Discipline	0.262	0.200	0.040

*Type I = General Mathematics, Pre-algebra
Type II = Algebra I, Geometry
Type III = Algebra II, Trigonometry, Calculus

Type I teachers have students doing written assignments (S8) three times as often as do Type III teachers. Students in Type I classes were observed to be not involved in any activity (S12) more than three times as often as Type III students. These data indicate that Type I students do not receive as much interactive instruction (S5, S6); they are more often given written assignments (S8) while the teacher does class management tasks such as grade papers or make lesson plans or keep records (S1). In an SRI study of secondary reading classes we found a negative relationship between this type of noninteractive instruction and student achievement. On the other hand, in that same study we found strong positive correlations, .63, between interactive instruction (discussion, S6) and student achievement. This type of instruction is seen in Type II and Type III classes.

A corroboration of this difference in teaching in Type I classes and Type II and III classes was found when we compared the teaching behavior of 11 teachers in our sample who taught both a Type I class and a Type II or III class. Six of these 11 teachers were observed in Type I and Type II classes, and five were observed in Type II and Type III classes. These individual teachers' classroom processes were investigated to determine if differences existed between the teaching processes for the same teacher in different types of mathematics classrooms.

Type I Versus Type II Classes

An analysis of teachers' profiles indicated that all six of the teachers who taught both Type I and Type II classes tended to assign more written work to the students in their Type I classes. Five of these teachers spent more class time doing management tasks and not interacting with their Type I students. While all of the teachers spent more time with their Type II students

in questioning and feedback activities, more interactions regarding mathematics were observed in the Type II classes for all six teachers.

These data indicated that the same teacher structured his or her class differently for different levels of mathematics classes. In the Type I classes, students worked alone doing written assignments more and the teacher devoted more class time to classroom management activities (such as correcting papers and organizing materials). Because of this type of classroom structure, the same teachers showed less interactive instruction with general mathematics students than with algebra I or geometry students. Time spent in instructing was almost twice as much for the algebra I and geometry classes as for the Type I classes. Type I students evidenced more misbehavior and less time-on-task. The main difference seemed that with Type I students, teachers tended to be non-interactive, and with Type II students they were interactive.

Type II Versus Type III Classes

For the five teachers who taught both Type II and Type III classes, no clear differences were found in the methods used in these classes. Teachers varied on whether an observed teaching process occcurred more in the Type II or Type III classes. The teachers in this group interacted more with the entire class when instructing their Type III classes. In the Type II classes, the teachers tended to interact more with groups or individuals. These teachers were also observed conducting more class

discussion in their Type III classes. This might indicate a trend for teachers to conduct more interactive discussion with students in their higher level classes and to involve the entire class in the discussion.

Discussion

These data reveal findings similar to the analysis involving all classrooms in the study. Clear distinctions can be found in the teaching processes for the same teacher in the Type I and Type II classes; however, less difference was shown in the manner in which the same teacher conducted a Type II and Type III class. The same teacher tended to interact less with students in the Type I classes than those in Type II classes. Type I students were assigned more independent desk work while the teacher used class time to correct students' work or organize materials. Nine of the 11 teachers led more class discussion in their higher level class.

The implications of this finding is that students in general mathematics classes may not receive the teacher attention and instruction required to achieve well and continue in mathematics studies.

Differential Treatment of Men and Women in Mathematics Classes

A hypothesis stated that differential treatment of men and women students would be observed in mathematics classrooms and this will be related to enrollment in advanced mathematics classes. To study this hypothesis we used observation data.

Observation

Twenty-two geometry classes were the focus of this analysis. Approximately 50% of the students in these classes were women. Therefore, the number of teacher interactions with men and women should be about equal if equal

treatment was being given. Table 2 displays the average frequency of observed interactions of teachers with male or female students during a geometry class period. These computations are based upon the total 22 geometry classes in the study.

Though few of the differences are statistically significant, the trend is rather clear. Men are spoken to more often than are women (F10, F11). Men ask more questions (F15, F16) and teachers ask men more questions (F18, F19). Women volunteer answers as often as do men (F34, F44) but the men are called upon to respond more frequently than are women (F40, F41). Men receive a little more individual instruction (F43, F44) and social interaction (F54, F55). Acknowledgement (F62, F63), praise (F65, F66), encouragement (F80, F81) and corrective feedback (F100, F101) are given slightly more frequently men than to women.

The only variable that occurs more frequently with women is positive interactions (F104), i.e., teachers smile or laugh more with women students than they do with men.

Discussion

Overall, men students are treated somewhat differently than are women students in geometry classes. This is in agreement with Bean's finding (1976) that showed teachers initiating more contacts with men students than with women students and with Dweck and Reppucci (1973) who suggest that mathematics teachers provide more feedback to men. Although we found such differences, they did not relate to the enrollment of women in advanced mathematics classes. On a questionnaire women stated they were more likely to enroll in classes where the instruction provided was actively interactive regardless of whether the interaction was with men or women.

Table 2

MEAN FREQUENCIES OF INTERACTION VARIABLES FOR GEOMETRY CLASSES

Variables		All Classes
F10	All interaction/female student-teacher verbal, math	38.69
F11	All interaction/male student-teacher verbal,math	46.88
F15	Female student question/math	5.60
F16	Male student qestion/math	6.59
F18	Teacher question/female student/math	3.72
F19	Teacher question/male student/math	4.60
F34	Female volunteer responses to teacher/math	1.23
F35	Male volunteer responses to teacher/math	1.67
F40	Teacher response/female student question/math	5.49
F41	Teacher response/male student question/math	6.32
F43	Teacher instruction/female student/math	5.48
F44	Teacher instruction/male student/math	6.56
F54	Teacher social interaction/female students	0.97
F55	Teacher social interaction/male students	1.41
F62	Teacher acknowledge female students/math	2.87
F63	Teacher acknowledge male students/math	3.59
F65	Teacher praise female student/math	0.26
F66	Teacher praise male student/math	0.34
F80	Teacher encouraging female student/math	0.23
F81	Teacher encouraging male student/math	0.26
F88	Interaction teacher-female student/relevance of math	0.00
F89	Interaction teacher-male student/relevance of math	0.07
F100	All corrective feedback/female students/math	8.03
F101	All corrective feedback/male students/math	10.13
F104	Teacher positive interaction with female students	0.41
F105	Teacher positive interaction with male students	0.40
F111	Teacher negative interaction with female student	0.06
F112	Teacher negative interaction with male student	0.14

Research on Teaching in Science Classrooms

Are the instructional strategies found to be effective in reading and mathematics classes similar for science classes? Very little research on teaching has been conducted in science classrooms. We can hypothesize that interactive instruction would be effective and that students staying engaged with their tasks would enhance their learning. Whereas drill and practice of reading and mathematics basic skills was helpful to the low achiever, an inquiry approach might be more appropriate for teaching science to low achievers. How should time be distributed across activities? How much time is spent for demonstrations or experiments and how much time for discussion, review, or written assignments? How are these variables related to student achievement in science? To answer such questions we have developed a comprehensive observation system to be used in science classrooms.

The observation system is composed of two sections. The first, the Classroom Snapshot, is so named because it records the environment and the participants in the classroom as if they were being photographed at one instant. It records every person in the classroom in the activity in which they are engaged and shows with whom they are engaged. The distribution of adults and students among the activities which are occurring simultaneously are recorded as the observer placed them on the grid going clockwise around the room. Essentially, the Snapshot provides data to assess the activities occurring, the materials being used, grouping patterns, teacher and adult participation, and students in activities independent of adults.

As shown in Figure I, the Snapshot, the classroom activities are listed down the left side of the page, and the materials are listed across the top. The observer records the information in each appropriate circle, recording each unique grouping occurring in the classroom. A completed Snapshot documents the number and kind of groupings, the activity and materials of each group, and whether an adult is present.

SCIENCE

CLASSROOM SNAPSHOT

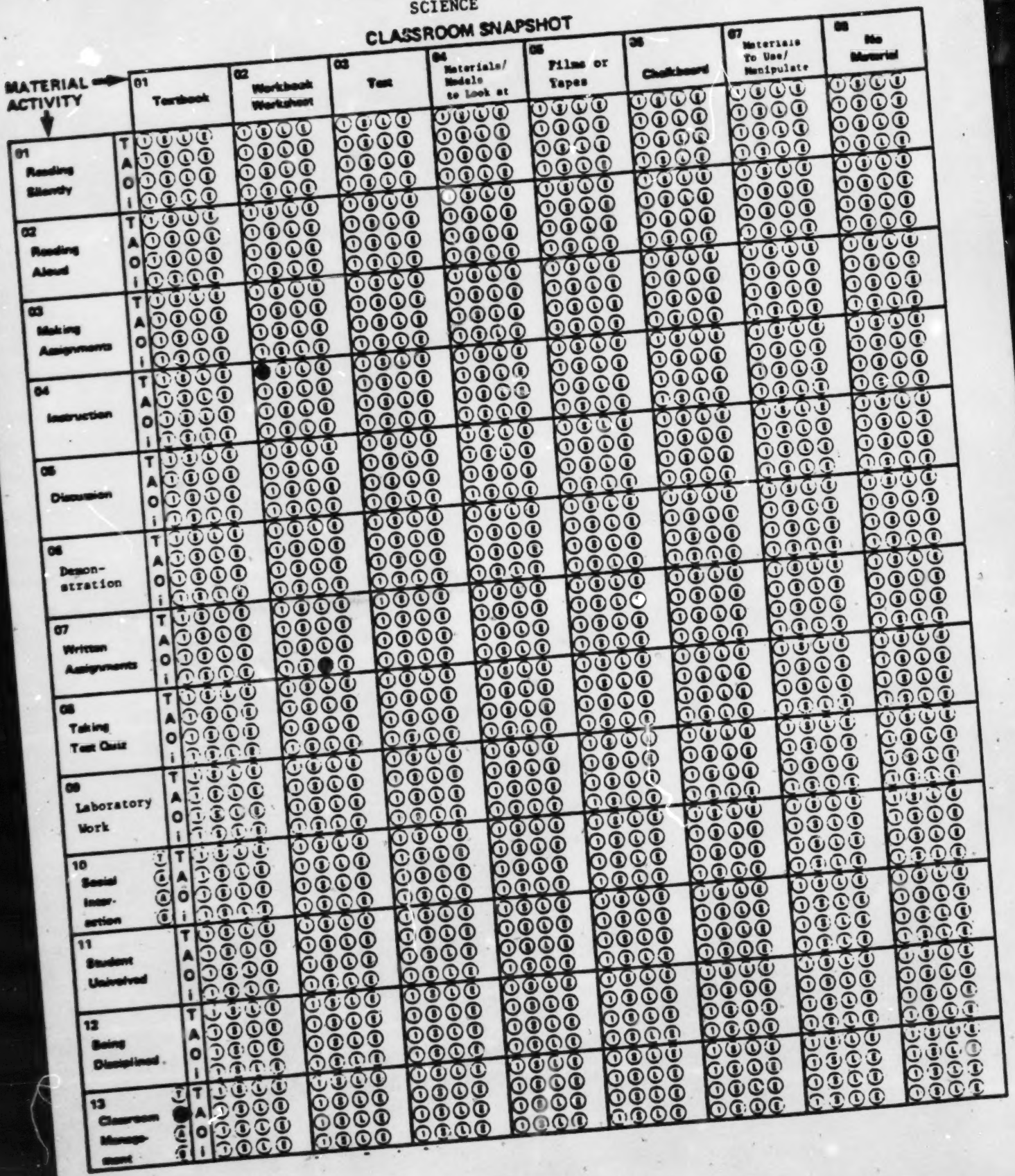

FIGURE 1

The letters at the beginning of each row indicate the placement of each category of participants in the classroom: T = Teacher, A = Aide, O = Other Adult, I = Independent Student. If it is a team teaching arrangement, each teacher is shown in the activity with the student or students with whom they are working when the Snapshot is recorded. The 1, S, L, and E in the bubbles in the row relate to the number of students with whom the teacher is working: 1 = One Student, S = 2-8 Students, L = 9 to one less than the total group, E = Everyone.

The bubbles marked in Figure I indicate that the teacher is giving instruction to one student in a workbook. The other students are working alone in workbooks. An aide is doing some classroom management task. Five grids are completed each 45 minute period and each class period is observed three days in a row.

Each Snapshot is followed by a five minute interaction observation that is focused on the teacher. Approximately 300 interactions are recorded per class period. The nature of the instruction can be assessed. Is it theoretical? Are there demonstrations? Are the questions thought provoking? Is the connective feedback guiding and supportive?

The advantage of objective observations systems such as this are several. First, observers are trained to a criterion during a seven day session and are checked regularly for acceptable reliability (<80%). Thus, the analyst can have confidence in the data. Second, these data are easy to use in testing relationships between classroom instructional strategies and student outcomes. Third, teachers are quite amenable to being observed with such a system since it is a straight count made by a person carefully trained to be objective. It is not someone's subjective opinion of what is occurring. The data can be used for staff development as well as for program evaluation.

The limitations are that the actual content of the curriculum cannot be described nor can the quality of the teachers' planning and execution be assessed. Some combination of quantitative and qualitative data would be useful to describe effective science teaching.

The system described above has been used in classes where physics, health, biology and general science were being taught. The interaction patterns were similar to those reported for the mathematics classes. In the more advanced classes there were demonstrations and discussions. The instruction was interactive. In the general science and health classes the students were working in workbooks and the teachers were monitoring, not instructing. Research in classrooms strongly suggests that students are more likely to learn in classrooms where the instruction is interactive. This sample is too small to make any statements about science instruction. A study is needed where a representative sample can be observed, criterion or normative test data can be gathered, and student attitudes toward science can be assessed. Effective instructional strategies need to be identified for each grade level and science subject.

Translating Research on Teaching to Teacher Training Programs

From observational research, each teacher can be given specific feedback that shows clearly how they distribute time across activities and how they interact with students. Figure 2 shows the type of profile we presented teachers of reading in secondary classrooms. Similar profiles could be generated for science teachers. The variables used in a quasiexperiment of Teaching Basic Reading Skills in Secondary Schools (Stallings, Needels and Stayrook, 1979) have considerable face validity which makes the findings understandable to teachers. The fact that the findings were generated from classes similar to the ones in which the teachers were working lent credibility to the research. The variables used in the study are very specific and translating

them into recommendations for teachers was not a difficult task. Each teacher received his/her own set of recommendations for behavior change based upon three days of observation in a class of his/her choice. For example, we observed Sam Jones' period No. 3 prior to a series of in-service workshops. He received the behavior profile shown in Figure 2. Sam Jones was spending 46% of the class time in management tasks (see pretest score for the first variable). This indicates that Sam was spending approximately one half of the class time not being involved with students, e.g., grading papers or keeping records. The mean for all teachers on this variable was 28%. After interpreting the study findings to Sam we made the recommendations shown in the left column. Our recommendation was to provide more instruction, more discussion, more feedback, and do less grading papers and record keeping during class time. A series of six workshops, which were very supportive and interactive, focused on how to manage classroom time, how to offer activities for different ability levels, and how to interact and be supportive to students. Following these workshops, Sam Jones was observed to be doing only 7% management activities (see post-test score). His style of instruction became much more interactive. The profile shows how time spent in activities changed from one point to another. Interestingly, Sam had been teaching 35 years. He found the changes made his teaching more fun, and the students became more involved. Overall, the teachers in this quasiexperiment did change behaviors as recommended and their students gained more in reading than did a comparison group of students in classrooms of teachers not attending the workshops.

Where to From Here?

For a few years following the announcement of Russia's Sputnik, policy makers and educators focused upon improving science and mathematics education. A number of experimental science programs were well funded until the end of the sixties. During the 1960s, the civil rights movement was making the general populace

TEACHER NAME: SAM JONES
LAKEWOOD HIGH SCHOOL
WASHINGTON UNIFIED SCHOOL DISTRICT

STANDARD DEVIATIONS FROM THE MEAN

Mean for All Classes

Less Frequent ←—— ——→ More Frequent

Snapshot Variables	Recommendation	< 2 S.D.	1 S.D.	0	1 S.D.	2 S.D. >	All Classes	Sam's Class Pre	Sam's Class Post	Implementation
Teacher class manage/no students	Less			0 ←		X	28.	46.	07.	✓
Total silent reading	Less			0 ←	X		08.	09.	05.	✓
Total reading aloud	More			X →		0	09.	06.	29.	✓
Total making assignments	OK		0 ←	X			06.	04.	00.	✓
Total instruction	More			0←X			10.	18.	13.	
Total discussion	More				X →	0	02.	04.	18.	✓
Total practice drill	More			XO			01.	00.	00.	
Total written assignments	OK			X→0			27.	17.	21.	✓
Total test taking	More			XO			02.	00.	00.	
Total social interaction	Less				0 ←	X	04.	15.	07.	✓
Total student uninvolved	Less			0 ←		X	05.	15.	01.	✓
Total discipline	OK			XO			00.3	00.	00.	✓
Interaction Variables										
Teacher to individual student	More		X →			0	89.	48.	113.	
Teacher to groups	More			X →		0	13.	01.	38.	✓
Teacher to class	OK			0 ←		X	44.	137	37.	
Teacher direct question, reading	More		X →		0		41.	23.	50.	✓
Student response, reading	More		X →		0		42.	19.	43.	✓
Teacher praise, support, reading	More		X →		0		13.	08.	34.	✓
Teacher corrective feedback	More				X →	0	13.	19.	53.	✓
All interactions/reading	More				X →	0	208.	230.	304.	✓
All interactions/behavior	OK			X →		0	06.	01.	11.	✓
All interactions/positive	More			X →	0		04.	00.	04.	
All interactions/negative	OK			XO			00.	00.	00.	✓
Student comments, assignment	OK		X→0				09.	01.	13.	✓
All interactions/class assignment	Less			0 ←		X	69.	144.	17.	✓
Teacher manage class, no student	Less			0 ←		X	33.	73.	05.	✓

X = Pre-Training Observation
O = Post-Training Observation
→ = Direction of change
✓ = Correctly Implemented

PROFILE OF SAM JONES' PRE- AND POST-TRAINING OBSERVATIONS

Figure 2

painfully aware that low income children were not thriving in our schools. In response to the need for an improvement in the life chances of this segment of society, vast sums of money were channeled into educational programs serving the economically and educationally handicapped. The primary focus of these programs was to improve basic reading, writing and computation skills. In the early seventies, as funding became limited and the effectiveness of the programs was not clear, funds for exploratory mathematics and science programs were drastically reduced or eliminated.

Having witnessed in the 1970s the plunge of the college bound students' test scores, many educators and policy makers are now feeling compelled to reinstate excellency in our high schools. In California, there is a new focus on the average and above average student. The great effort to assist the low achievement and handicapped students has sometimes led to neglect of the middle and upper segments of our student bodies. Higher standards for graduation are being considered for these students. The state of North Carolina is trying to find a remedy for working with these gifted and talented students. They have recently opened a School of Science and Mathematics. It is a free residential public high school that offers a pre-collegiate curriculum to 150 bright, technology-oriented eleventh grade students. The students, 30 of whom are black, include sons and daughters of farmers, construction workers, professors and business men. They were selected out of 900 applicants and were identified as those who have the potential for making contributions to the fields of science and mathematics. Though the school has been attacked as being elitist, the Governor, James B. Hunt, Jr., has backed it because, "I'm concerned about the loss in productivity in American industry and the loss of our competitive edge in the whole technological field. At the high school level, we simply are not doing the best job we can do."

Clearly, it is time to focus again upon excellence in instruction for the average and above average student. It is important to keep in mind that all students in our public schools need to be taught so that they can enjoy and contribute to their greatest potential. This means that no single segment of society should receive the lion's share of he resources. At this time in the history of education we must consider for now and the future what kind of citizens the school system should be developing. What kind of people are required to solve the problems of food, clothing, and shelter in an expanding world population and dwindling resources? What kind of technological skills are required to function productively in this society? What kind of basic and human skills are required to make democracy work? The pendulum of educational emphasis swings back and forth. It is important to find a middle position that will allow all students to thrive and fulfill their potential. Classroom teachers and teachers of teachers have a special trust. Research in the 1970s indicates very clearly that what is happening in classrooms now makes a difference in how our children will grow and develop in the 1980s.

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